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DIRECT SEEDING WESTERN WHITE PINE -- FIFTH-YEAR RESULTS

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This report summarizes the results of a series of direct seeding experiments with western white pine after five growing seasons. Initial establishment of the seedlings during the first two to three growing seasons, experimental methods, and detailed descriptions of the areas, have been related in earlier reports by Schopmeyer (2,3,4) and McKeever (1).

The first series of plots, composed of seed spots, were sown in the fall of 1937 and spring of 1938 on level benches and north slopes which had been clearcut and broadcast burned within the previous year or two. The early results showed that fall sowing gave better initial establishment than spring sowing. Hence, the follow-up work reported here deals only with tests in which the seeds were sown during the fall. Covering the seed spots with conical wire screens during the first year to protect them from seed-eating rodents caused highly significant increases in seedling establishment. Therefore, seed spotting with western white pine as a means of reforesting new burns on north slopes or level benches appeared to have considerable promise when the seeds were fall-sown and given protection from rodents.

Seedling survival on the early tests has decreased very little in subsequent years. Five years after establishment 78 percent of the screened spots supported one or more seedlings (Table 1). Stocking on unscreened spots was much less satisfactory, only 27 percent. The number of seedlings per stocked spot averaged 6.6 on screened spots, four times as many as on unscreened spots.

Table 1.--Stocking of fall-sown western white pine on screened[1/] and unscreened seed spots at end of fifth growing season

Location of Area	Description of Area	Rodent Protection	Fifth-year stocking: Stocked spots[2/]	Fifth-year stocking: Seedlings per stocked spot
			Percent	Percent
Kalispell Creek, Kaniksu N. F.	Level bench, clearcut and broadcast burned fall of 1936	Screens	72	7.0
		None	25	1.6
Kalispell Creek, Kaniksu N. F.	Level bench, clearcut and broadcast burned fall of 1936	Screens	86	6.9
		None	13	1.5
Sands Creek, Coeur d'Alene N.F.	North slope, clearcut and broadcast burned fall of 1937	Screens	60	5.3
		None	31	1.5
Solitaire Creek, Coeur d'Alene N.F.	North slope, clearcut and broadcast burned fall of 1937	Screens	96	7.3
		None	40	1.7
Average		Screened	78	6.6
Average		Unscreened	27	1.6

1/ The screens were removed one year after seed sowing.
2/ Spots with one or more live seedlings.

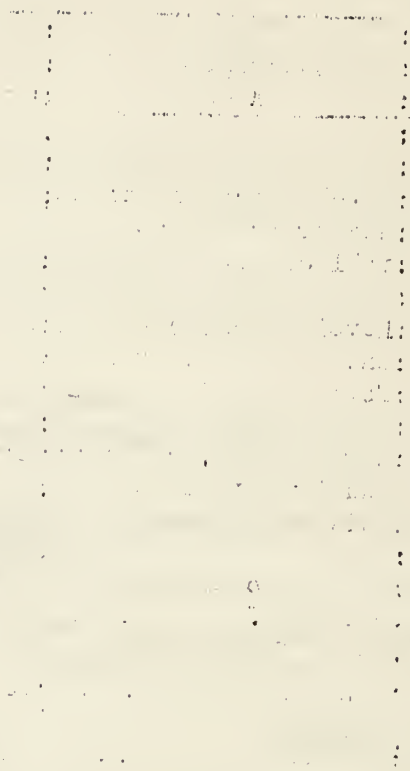
Poisons for Rodent Control

The experiments with conical wire screens showed clearly that protection from seed-eating rodents must be provided. However, screens are too cumbersome and expensive for use in large-scale reforestation projects. Hence, experiments in the use of poisons for rodent control were undertaken using poisoning methods developed by the U. S. Fish and Wildlife Service.

The methods tested were (1) poisoning with thallium sulphate-coated hulled sunflower seed placed in small piles at intervals of 15 to 20 feet, using one pound of bait per acre, about one week before sowing the tree seed; and (2) sowing tree seeds coated with a mixture of yellow dextrine, plaster of Paris, cornmeal, and strychnine alkaloid. The two poisoning methods were tested separately and in combination.

The areas where poisoning was studied ranged in size from 10 to 50 acres. The tests were initiated partly in the fall of 1938 and partly in the fall of 1939.

Stocking at the end of five growing seasons was practically the same on



areas prepoisoned and sown with poisoned seed as on areas prepoisoned but sown with unpoisoned seed (Table 2). On the area that was not prepoisoned but was sown to poisoned seed, fifth-year stocking was relatively low.

Table 2.--Fifth-year stocking of direct-seeded white pine using poisons for rodent control

Location of Area	Description of Area	Poisoning Method	Fifth-year stocking: Stocked spots	Fifth-year stocking: Seedlings per stocked spot
			Percent	Number
Sands Creek, Coeur d'Alene National Forest	Northwest-facing ridge top, clearcut and broadcast burned in 1938.	Prepoisoned, poisoned seed	79	3.4
Kalispell Creek, Kaniksu National Forest	North slope clearcut and broadcast burned in 1939.	Prepoisoned, poisoned seed	67	4.1
Kalispell Creek, Kaniksu National Forest	Level bench clearcut and broadcast burned in 1938.	Prepoisoned, poisoned seed	67	3.2
Average		Prepoisoned, poisoned seed	71	3.6
Kalispell Creek, Kaniksu National Forest	North slope clearcut and broadcast burned in 1939.	Prepoisoned, unpoisoned seed	70	3.4
Kalispell Creek, Kaniksu National Forest	North to northwest slopes clearcut and broadcast burned in 1939.	Not prepoisoned, but poisoned seed	41	2.5

These experiments show that satisfactory stocking can be obtained in direct seeding white pine if seeds are protected from rodents by prepoisoning the area about one week before seeding. Stocking on prepoisoned areas compared reasonably well with that obtained by the use of screens for rodent protection. It appears that poison-coated seeds do not alone provide adequate rodent protection. When used in conjunction with prepoisoning it contributed little to the effectiveness of control.

Broadcast vs. Spot Sowing

Broadcast and spot seeding have been compared in only one test, established in the fall of 1939 on a north-facing slope on Honey Creek, Coeur d'Alene National Forest. The tract had been clearcut and prescribed broadcast burned in 1939. The seeding areas were poisoned about one week prior

to seed sowing. Approximately 20 poisoned seeds per spot were sown in seed spots spaced at 8-foot intervals or about 14,000 seeds per acre. Broadcast sowing was done by hand, also using poisoned seed, at the rate of 50,000 seeds per acre.

At the end of the fifth year, 47 percent of the seed spots were stocked. Stocking on the broadcast-sown area was 73 percent on the basis of 64-square-foot units (the equivalent of 8 x 8 spacing). There were 497 stocked sampling units per acre on the broadcast-sown area and 320 stocked spots per acre on the spot sowing. Broadcast sowing, although seemingly of promise, has not been tested sufficiently to warrant conclusions.

Seed Spotting on an Administrative Scale

Ninety-seven acres on Honey Creek were sown to white pine in the fall of 1940 as a test of direct seeding on an administrative scale. The test area, with north and east exposures, was clearcut and broadcast burned in 1939. The area was prepoisoned, using one-half pound of bait per acre. Seed spots with a 7.5-foot spacing were sown with approximately 27 poison-coated seeds per spot, although 15 to 20 seeds was the intended rate. The same area was planted with 2-2 white pine stock in the spring of 1942.

The stocking percentage of the seed spotting increased from 61 percent the first year to 62 percent the fifth year, and the number of live seedlings per stocked spot increased from 2.2 to 3.0, due to delayed germination. After one growing season, survival on the planting was 98 percent.

The five-year-old seedlings are now firmly established. However, the nursery transplant trees, although field planted $1\frac{1}{2}$ years later, have the advantage in height as compared with the seedlings from the spot sowing. The nursery-grown seedlings also have the advantage of being distributed singly rather than in groups like some of the trees in seed spots.

Nursery-grown trees excel in initial rate of growth, adaptability to a wider range of planting conditions, distribution of the trees, and probability of successful establishment in years of subnormal moisture.

Comparative Costs of Direct Seeding and Tree Planting

Costs and production rates on the larger-scale seeding tests indicated that the initial costs of seed spotting about equalled those for tree planting on comparable sites.

The labor for preparing and planting a seed spot was practically the same per spot as for planting a tree. The principal time element in the preparation of a seed spot was that involved in "scalping" (removing the humus and roots from an 18-inch circle of soil with a hazel hoe). Average, well-trained workers can plant about 700 trees or seed spots per 8-hour day on the freshly burned areas where direct seeding has the greatest promise.

Seed used in spot sowing had practically the same value as the numbers

of 2-0 nursery-grown white pine trees needed to reforest equal areas. However, seed is considerably less expensive than 2-2 white pine, the class of nursery stock usually preferred for field planting. White pine seed for sowing 800 spots per acre costs $3.34 (0.835 lb. at $4.00). Eight hundred 2-0 white pine seedlings cost $3.60 and the same number of 2-2 white pine stock costs $7.20, delivered to the planting site. Seed costs could be reduced by sowing fewer spots. However, seedling establishment records indicate this may not be safe.

Broadcast sowing results in a considerable saving of labor, but requires the use of almost 4 times as much seed as spot sowing.

Prepoisoning preparatory to direct seeding required about 2 man-hours of labor per acre. The bait used cost about 25 cents per acre. Spreading poison bait is an added cost of direct seeding that tends to offset savings made over the use of planting stock.

CONCLUSIONS

These experiments show that reforestation of white pine by sowing seeds in spots can be successfully accomplished when adequate protection from seed-eating rodents is provided and the sowing done in the fall on newly burned north slopes and flats. Poisoning the areas with one pound of thallium sulphate-coated hulled sunflower seeds per acre one week before sowing appears to provide the necessary protection. Although a test of broadcast sowing resulted in better stocking than seed spotting in that particular instance, broadcast sowing must be more thoroughly tested before conclusions can be made. Seed spot sowing was successfully accomplished on an administrative scale at about the same cost as that of planting nursery transplant stock.

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